- ultrasonics applied to pipe, not glass
- liquid bath, or direct contact of pipe → transducer

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(72) Inventor GARETH THOMAS MORGAN

(19) THE PATENT OFFICE LONDON

(54) IMPROVEMENTS RELATING TO BEER DISPENSING

(71) We, WHITBREAD & COMPANY, a British Company, of Chiswell Street, London, EC1Y 4SD, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

It is generally considered that the sales appeal of beer, and in particular draught beer, is enhanced if it is provided with a head when it is dispensed into a drinking glass or mug. It is desirable for the head to be of a fine, firm texture and to be closely-knit so that the head is durable and the liquid beer passes through the head above it as it is consumed. It is also considered to be desirable for the head to give a good lacing to the glass as the beer is consumed.

The head on a bottled or canned beer may be improved by increasing the content of carbon dioxide in the beer. However this solution cannot be applied to draught beers partly because of the tastes of the consumers and partly because of the difficulty that exists in attempting to dispense the required quantity of beer. This is a particularly serious fault when metered dispensing systems are used.

Existing devices for encouraging the head formation on draught beer tend to suffer from the disadvantage of poor control, so that either too much or too little head is formed. In the past, the head on a beer has been encouraged either by using a cavitation plate at the dispensing point so that all the beer dispensed passes through the cavitation plate, or by introducing gas into all of, or the last part of, the stream of beer as it is dispensed. The former of these tends to result in far too much foam being produced resulting in great difficulty in dispensing the beer whilst the latter results in a very open textured, short-lived head.

prior art cavitation plate"? ? also to be a-line.

It has now been discovered, in accordance with the present invention, that a very satisfactory and controlled head can be formed on a carbonated beverage as it is dispensed into a drinking vessel by subjecting at least part of the beverage to vibrations at an ultrasonic frequency whilst the beverage is flowing in a pipe which leads from a bulk container to a dispensing opening.

Preferably the ultrasonic vibrations are applied for only a minor proportion of the time for which the carbonated beverage is dispensed. In this case it also preferable that the vibrations are applied to the portion of the beverage that is subsequently first dispensed and thus the bubbles of gas that are liberated from the carbonated beverage to form the head have to ascend through a depth of beverage subsequently dispensed. This enables a better head to be formed.

It is a feature of this invention that the bubbles of gas that are formed in the beverage by the application of the vibrations are numerous and are extremely small when compared with the bubbles produced by the other methods of dispensing. Thus, the bubbles only rise slowly to the surface and this slow rise gives time for the surface active materials, on which the nature and stability of the head depends, to migrate to the surface of the bubbles and contribute to the creaminess and durability of the resulting head.

The invention also includes a dispensing system for dispensing a carbonated beverage from a bulk container into a drinking vessel, the system comprising a dispensing tap, a pipe connected at one end to the tap and adapted to be connected at its other end to the container, so that, in use, beverage passes from the container to the tap along the pipe, and an ultrasonic generator and transducer, the transducer being coupled to the pipe so that, in use, ultrasonic vibrations generated by the transducer pass from the transducer to the beverage contained within the pipe.

The pipe may be made of a flexible plastics material and pass through a liquid bath to which ultrasonic vibrations are applied. The liquid thus acts as the coupling between the transducer and the beverage contained in the pipe, but, it is preferable that the pipe

joining the storage bulk container and the dispensing tap is rigid, or semi-rigid, over part of its length and this rigid, or semi-rigid, part is bonded or clamped directly on to the active face of the ultrasonic transducer.

Preferably the dispensing system also includes a switch either fixed to and operated by the dispensing tap or a flow switch operated by the flow of liquid through the pipe when the tap is opened, so that the ultrasonic generator is switched on when the beverage is dispensed through the pipe.

The system may also include a timing mechanism so that the period of time for which the ultrasonic generator is operated may be varied. This improvement may also be used in conjunction with a metered dispensing system. In this case the transducer is preferably placed downstream from the meter so that the gas bubbles are only liberated from the beverage after the beverage has been metered, thereby ensuring the required quantity of beverage is dispensed.

An example of a method and three examples of dispensing systems in accordance with the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a flow diagram of the first system which is capable of dispensing four different types of beer;

Figure 2 is a block diagram of an electrical control circuit for the system shown in Figure 1;

Figure 3 is a perspective view of the transducer unit for the system shown in Figure 1;

Figure 4 is a cross-section through the transducer unit shown in Figure 3;

Figure 5 is a flow diagram of the second system;

Figure 6 is a block diagram of an electrical control circuit for the system shown in Figure 5;

Figure 7 is a perspective view of a transducer unit used in the third example; and,

Figure 8 is a section through the transducer unit shown in Figure 7.

The first example is of a beer dispensing system in which four separate beer supply circuits utilise a common transducer unit. As the transducer unit tends to be an expensive piece of equipment this system results in a considerable saving and is thus preferred. In this example a cylinder 1 contains carbon dioxide under pressure, the carbon dioxide being fed through a valve 2 into a manifold 3. The manifold 3 is connected to four separate kegs 4a, 5a, 5b and 4b through valves 6a, 6b, 6c and 6d respectively. The kegs 4a and 4b contain 2.0 volume Lager type beer whilst the kegs 5a and 5b contain 1.3 volume Bitter type beer. That is to say one unit volume of Lager type beer contains and will liberate 2.0 unit volumes of carbon dioxide whilst one unit volume of Bitter type beer contains and will liberate 1.3 unit volumes of carbon dioxide. From the kegs 4a and 4b the lager type beer passes through cooler units 7a and 7b and thence through the transducer unit 8 to the dispensing taps 9a and 9b. From the kegs 5a and 5b the Bitter type beer passes directly to the transducer unit 8 and then to dispensing taps 10a and 10b.

Transducer unit 8 is shown in more detail in Figure 3. It comprises an electro-accoustic transducer having four stainless steel pipes 11 bonded on to its active face. The transducer is a type 6769a made by Dawe Instruments Limited and described in British Patent Specification No. 957,802. This transducer comprises a piezo-electric crystal 12 of lead titanite zirconate known as PZT clamped between a steel backplate 13 and an aluminium resonant horn 14 having a corrugated front face 15. The corrugated front face 15 is seen most clearly in Figure 4. The stainless steel pipes 11 are 5/16th inch internal diameter and are bonded into the furrows of the corrugated face 15 of the transducer by epoxy resin adhesive 16. The transducer is tuned to resonate at 40 kilo Hertz. The stainless steel pipes 11 are joined to the rest of the dispensing system by neoprene tubes 17 which are held in place by retaining clips 18.

The control circuit for this first example is shown in Figure 2 and consists of switches 20, 21, 22 and 23 attached to the dispensing taps 9a, 10a, 10b and 9b respectively and connected to a timer 24. The switches 20, 21, 22 and 23 may be flow switches in the pipes leading towards the dispensing taps 9a, 10a, 10b and 9b or they may be mercury switches attached to each of the four dispensing taps. In this latter case the switch is arranged so that as the handle of the tap is pulled forward to open the tap, the mercury in the mercury switch joins the two electrodes in the switch and, in use, activates the timer unit.

The timer unit 24 and an ultrasonic generator 25 are supplied with power from an isolation transformer 26. The isolation transformer 26 is a step-down mains to 24 volt transformer and it is used as a power supply because an operator frequently has wet hands when the beer dispensing mechanism is being operated. Because of the well known dangers of handling any electrical apparatus with wet hands it is therefore customary for all electrically operated apparatus that is used behind the bar to operate from a 24 volt supply. The ultrasonic generator 25 drives the transducer 8 at 40 kHz and is controlled by the timer 24. The timer 24 can be arranged to turn the ultrasonic generator 25 on for a time period which can vary between half a second and four seconds and it

is of the type manufactured by Dawe Instruments under the model number 6690-1a.

The timer unit 24 is switched on by opening one of the dispensing taps 9a, 10a, 10b and 9b which closes a corresponding one of the switches 20—23. When the timer is switched on it switches on the ultrasonic generator 25 and after a pre-set time the timer 24 switches off the ultrasonic generator 25. The timer is reset when the particular switch that triggered it is once again opened. In this particular example it has been found that a time period of one second gives the best results.

It is common practice to dispense highly carbonated beers, for example Lagers, through pipes having an internal diameter of 3/16th inch. This helps to control the quantity of head produced on the beer as it is dispensed and prevents excess foaming of this beer in the pipes. However ordinary Bitter type beer is easily dispensed through pipes having an internal diameter of 5/16th inch. Therefore the flow rate of Bitter beer is greater than the flow rate of Lager and hence the quantity of the beer that is exposed to ultrasonic vibrations may be controlled not only by varying the length of time for which the vibrations are applied but also by controlling the flow rate of the beer past the transducer head. In this example the flow rate of Lager through the dispensing taps 9a and 9b is less than the flow rate of Bitter type beer through the taps 10a and 10b. Thus the timer may be set to give the required quantity of head on the Bitter beer and then the quantity of head on the Lager may be controlled by varying the flow rate of the Lager. This is how it has been found that a time period of one second gave the best results for both types of beer. In this instance as the Lager is also passed through the coolers 7a and 7b this also reduces the tendency for the Lager to form a head and hence some degree of control may also be exercised in this way.

The flow rate of the Bitter beer is set so that half a pint is dispensed in six seconds whilst the flow rate of the Lager beer set so that half a pint is dispensed in nine seconds. When either type of beer is dispensed they are both formed with a firm, close-knit textured head that is durable and lasts throughout the time that the beer is being consumed. Both these heads give a good lacing to the sides of the glass as the bear is consumed.

Alternatively switches 20—23 may each be linked to a separate timer so that the amount of ultrasonic vibration given to each separate beer as it passes through the pipes over the transducer may be varied in accordance with the nature of the beer being dispensed. In this example we have described the system only containing two different types of beer, however each keg may contain a different beer and in this case the timer is, or timers are, adjusted to give the optimum head on each type of beer.

A second system, shown in Figure 5, is used to dispense 1.3 volume Bitter type beer. The system comprises a cylinder 30 which contains carbon dioxide under pressure and is connected through a valve 31 to a pipe 32. The pipe 32 is coupled to a keg 33, which contains the beer, so that the carbon dioxide from the cylinder 30 is introduced into the keg 33 above the level of the beer in the keg. A spear 34 which extends below the level of beer in the keg 33 is joined to a pipe 35 leading from the keg 33 to the input of a beer meter 36. A pipe 37 leads from the output from the beer meter 36 to a transducer unit 38. The transducer unit 38 is similar to the one shown in Figure 3 except that it has only one pipe bonded on to its active face. A short length of pipe 39 joins the transducer unit 38 to a dispensing tap 40. The dispensing tap 40 includes a mercury switch 41, which is shown in Figure 6 and is attached to the tap 40. The switch 41 is arranged so that as the handle is pulled forward to open the tap, the mercury in the mercury switch joins the two electrodes in the switch as in the previous example.

The carbon dioxide from the cylinder 30 which is introduced into the keg 33 maintains the beer in the keg at a super-atmospheric pressure and hence tends to drive the beer through the spear 34 into the pipe 35. The beer meter 36 which is electrically operated dispenses exactly one half a pint of beer in each operation into the pipe 37. This measured amount of beer flows through the pipe 37, the transducer unit 38, the pipe 39, the tap 40 and into a mug or glass placed beneath the outlet of the tap 40. The cylinder 30, the keg 33, the beer meter 36 are usually contained in a cellar some distance away from the tap. However the transducer unit 38 is placed as close as practicable to the dispensing tap 40 and in this example the length of the pipe 39 is two feet so that the volume of beer contained in the pipe 39 is 30 ml.

The electrical control circuit for this second example is shown in Figure 6 and includes the mercury switch 41 which is connected to a relay unit 42. This relay unit 42 controls both the beer meter 36 and a timer 43. The timer 43 governs the operation of an ultrasonic generator 44 which is connected to and drives the transducer unit 38. A step-down mains to 24 volt isolation transformer 45 is used as a power supply for the beer meter, the relay unit, the timer and the ultrasonic generator.

In use the valve 31 is opened so that the carbon dioxide from the cylinder 30 pressurises the keg 33, the main power supply is switched on to the input of the isolation transformer 45 and then the system is ready for use. The beer dispensing tap 40 is opened

and this closes the switch 41. This energises the relay unit 42 and closes two sets of contacts in the unit 42. The first set of contacts actuates the beer meter 36 to dispense a half a pint of beer whilst the second set of contacts energises the timer 43 controlling the ultrasonic generator 44 and hence the transducer 38. The beer meter 36 dispenses half a pint of beer into the pipe 37 in six seconds and the timer 43 starts the ultrasonic generator as soon as the dispensing tap 40 is opened and then switches the generator 44 off soon afterwards. The length of time for which the ultrasonic generator 44 is activated can be varied by adjusting the timer 43. In this example the best results were obtained when the generator was operated for a period of one second. The timer 43 is reset by the contacts of the relay unit 42 opening when the beer dispensing tap 40 is closed. Since the length of the pipe 39 is only two feet, the beer that has been treated by the ultrasonic vibrations is dispensed into a glass early in the dispensing cycle.

With the system arranged in this way the bubbles of gas that are liberated by the ultrasonic vibrations have to travel through nearly the entire contents of the glass before they reach the surface and form the head. These bubbles are very small and because of this and because they are liberated early in the cycle and thus to move throughout almost the entire height of liquid, they take a long while to rise to the surface of the glass to form the head. This time enables the surface active materials to migrate towards the walls of the bubbles and the surface active materials contribute towards the creaminess and durability of the resulting head. In this example the ultrasonic generator also generates a frequency of 40 kHz. The resulting head is of a fine, firm, close-knit texture, it lasts throughout the time that the beer is being consumed and it gives a good lacing to the sides of the glass.

The third example is essentially very similar to the first example except for the design of the transducer unit. In this example the pipes are not bonded to the transducer but merely clamped onto the active face of the transducer. The control circuit and the operation of this example is directly similar to that of the first example but in the third example the pipes joining the bulk container to the dispensing opening are made from nylon and thus are made from a semi-rigid material. Figures 7 and 8 show the transducer unit used in this example and this transducer unit includes a transducer similar to that shown in Figure 3 and 4 having an acoustic aluminium horn 14 to the periphery of which is attached a flange 50. Nylon pipes 51 and 54 lead from cooler units 7a and 7b whilst pipes 52 and 53 lead directly from the kegs 5a and 5b. The pipes 51, 52, 53 and 54 are then joined to the dispensing taps 9a, 10a, 10b respectively. The pipes 51, 52, 53 and 54 are sandwiched between the active face 15 of the transducer and an upper plate 55 having a corrugated lower face 56. The upper plate 55 is clamped onto the transducer unit by four clamping screws 57 which extend through holes in the plate 55 and are screwed into the flange 50. By adjusting these clamping screws 57 the clamping pressure between the pipes 51, 52, 53 and 54 and the active face 15 of the transducer 14 can be varied.

The remainder of the system is identical to that of the first example and the results that were obtained when this transducer unit replaced the transducer unit described in the first example were the same.

WHAT WE CLAIM IS:—

1. A method of dispensing a carbonated beverage into a drinking vessel which includes the step of subjecting at least part of the beverage to ultrasonic vibrations whilst the beverage is in a pipe leading from a bulk container to a dispensing opening to form a head on the beverage in the vessel.

2. A method according to claim 1, in which the vibrations are only applied for a minor proportion of the time for which the beverage is dispensed.

3. A method according to claim 2, in which the vibrations are applied immediately the dispensing of the beverage begins.

4. A method according to any one of the preceding claims, in which the carbonated beverage is a draught beer.

5. A method according to any one of the preceding claims, in which the frequency of the vibrations is substantially 40 kHz.

6. A dispensing system for dispensing a a carbonated beverage from a bulk container into a drinking vessel the system comprising a dispensing tap, a pipe connected at one end to the tap and adapted to be connected at its other end to the container, so that, in use, beverage passes from the container to the tap along the pipe, and an ultrasonic generator and transducer, the transducer being coupled to the pipe so that, in use, ultrasonic vibrations generated by the transducer pass from the transducer to the beverage contained within the pipe.

7. A dispensing system according to claim 6, in which the pipe is rigid over at least part of its length and this rigid part is bonded directly on to an active face of the transducer.

8. A dispensing system according to claim 6, in which the pipe is semi-rigid over at least part of its length and this semi-rigid part is clamped onto an active face of the transducer.

9. A dispensing system according to any one of claims 6 to claim 8, which includes

a timer for controlling the length of time for which the ultrasonic vibrations are applied to the beverage in the pipe.

10. A dispensing system according to any one of claims 6 to claim 9, in which the ultrasonic generator is controlled by a switch operated automatically upon opening the dispensing tap.

11. A dispensing system according to any one of claims 6 to claim 10, which also includes a dispensing meter, the transducer being positioned downstream from the meter.

12. A method according to claim 1, substantially as described with reference to the accompanying drawings.

13. An apparatus according to claim 6 constructed substantially as described with reference to Figures 1—4, Figures 5 and 6, or Figures 7 and 8 of the accompanying drawings.

For the Applicants:—
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52 Chancery Lane,
London, WC2A 1HN.

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Sheet 1

Fig. 1.

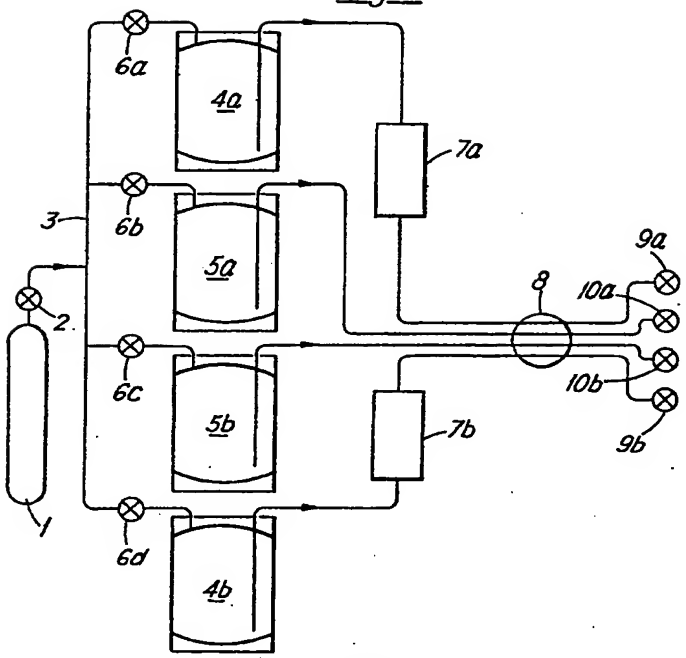


Fig. 5.

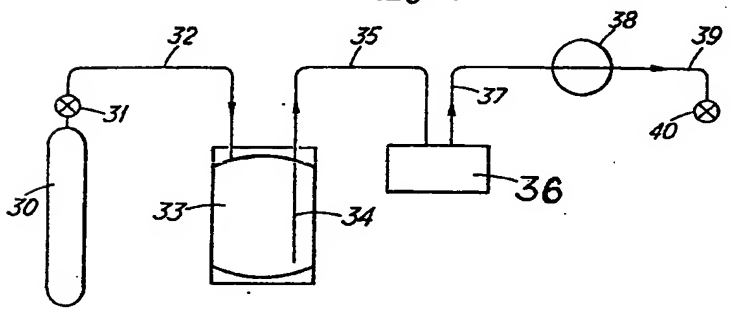


Fig. 2.

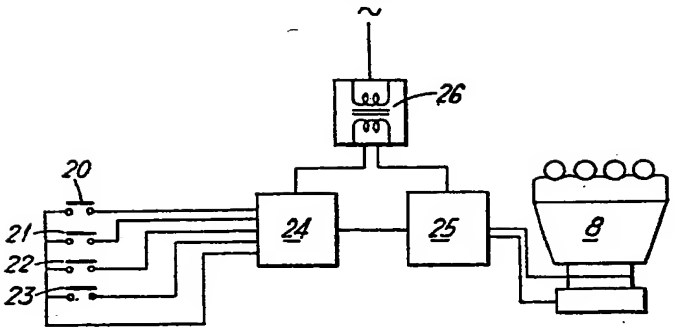
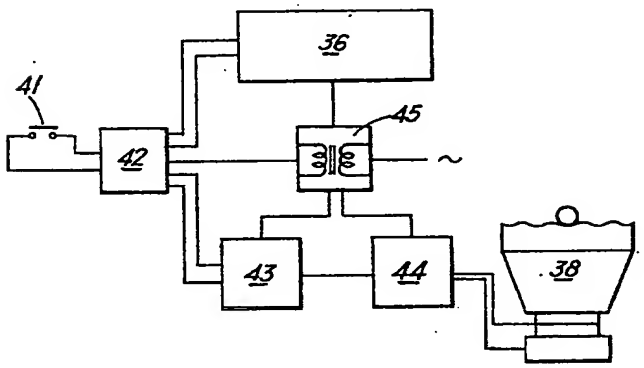


Fig. 6.



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Sheet 3

Fig.3.

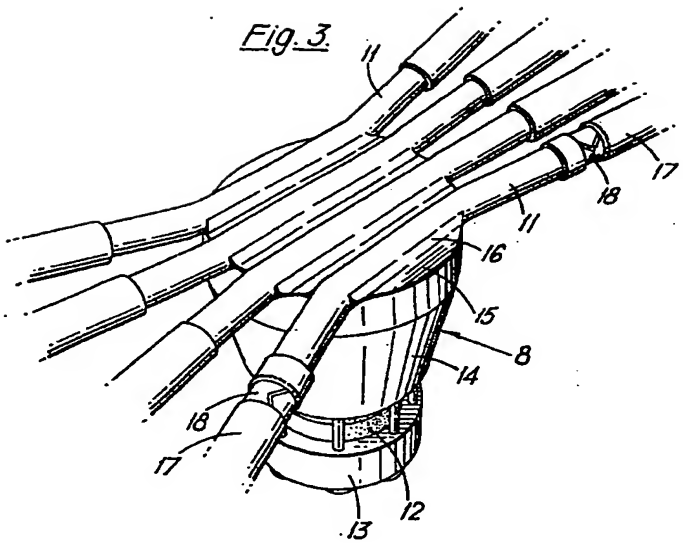

Fig.4.

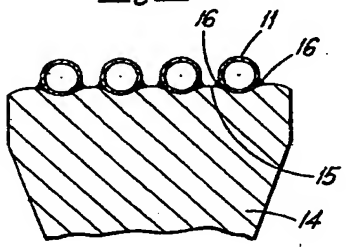

Fig. 7.

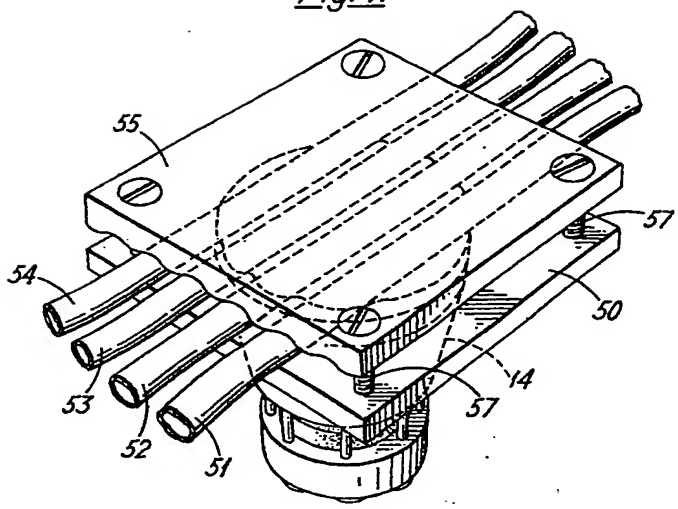

Fig. 8.